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Counterfeiting of banknotes in Poland

Preface

Money plays a key role in economic and social relations in every country. It fulfils three basic functions: it is a medium of exchange, a store of value and a unit of account. The two basic functions of money – the functions of a medium of exchange and a store of value – make it very attractive from the point of view of criminals. This applies both to coins made of gold or silver (having an intrinsic value in the precious metal itself[2]) and to banknotes (only with a face value and a commitment or guarantee from the issuing bank). With the relatively low cost of producing counterfeits, criminals have the opportunity to obtain a very high rate of return on their crime. This rate of return has accompanied counterfeiters practically since the appearance of money in circulation. Thus, it concerned the past epoch of gold coins functioning in normal circulation (counterfeited with base metals) and it does concern the present day, when banknotes are a store of significant value.[3] Mass production techniques available today, including mass duplication and printing, enable economies of scale that were impossible to achieve in the more distant past. The economies of scale significantly increase the attractiveness of counterfeiting banknotes, as it lowers the unit costs of producing counterfeits, and at the same time reduces the time of their creation. Of course, the higher the face value of the counterfeit notes, the higher the crime rate. For this reason, counterfeit-

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[2] Gold coins and coins made of other precious metals are still in circulation, but they are not a medium of exchange. Rather, they are only a store of value.

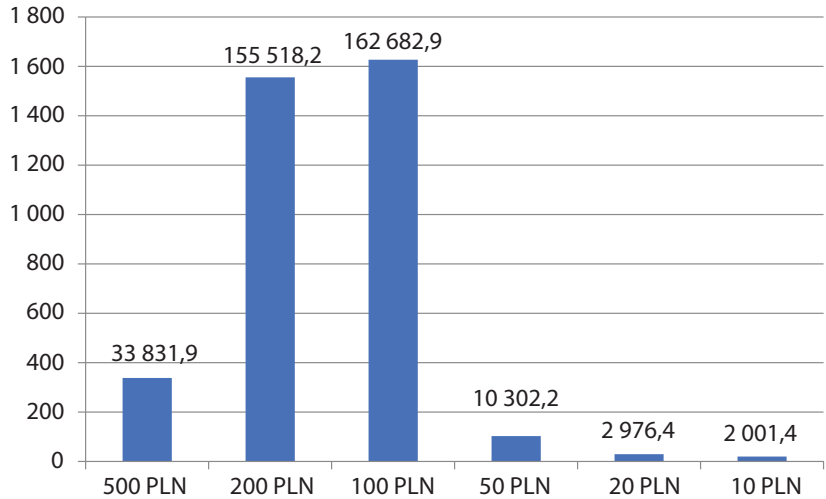
[3] Gold coins and coins made of other precious metals still exist in economic circulation, but they do not constitute a medium of exchange. Rather, they are only a carrier of value and perform a hoarding function (storing value).

ing concerns primarily (but not exclusively) banknotes and not coins, as banknotes usually have a significantly higher face value than coins, and the cost of producing counterfeits is relatively low.

There are 6 denominations of circulation banknotes in Poland: PLN 10, 20, 50, 100, 200 and 500 PLN. The volume of these banknotes in circulation is shown in Fig. 1. The highest nominal value of a circulating coin in Poland is PLN 5, *i.e.* 50% of the value of the lowest denomination banknote.

Fig. 1

Number of Polish banknotes in circulation in millions, data as of September 30, 2022.



Source: https://www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/struktura-obiegu.html, structure of banknote circulation in Poland, December 20, 2022.

The chart above presents the structure of the circulation of Polish banknotes, *i.e.* those in circulation at the end of the third quarter of 2022, reduced by the number of banknotes in NBP vaults, banknotes deposited by the central bank in vaults of other banks and those withdrawn by NBP due to their degree of wear. The most popular banknote in Poland is PLN 100, with a circulation volume of 1.6 billion. This represents 53.7% of all Polish banknotes in circulation. The second most popular banknote is PLN 200 (25.7% of the number of banknotes in circulation), and the third – PLN 50 (6.8% of the number of banknotes in circulation). With the exception of PLN 500, these three banknotes represent both the highest denomination and the highest quantity in terms of circulation. The PLN 500 banknote is an exception as it was introduced relatively recently[4] and its denomination may be perceived as relatively high in relation to the value of cash transactions in Poland, which causes some reluctance to

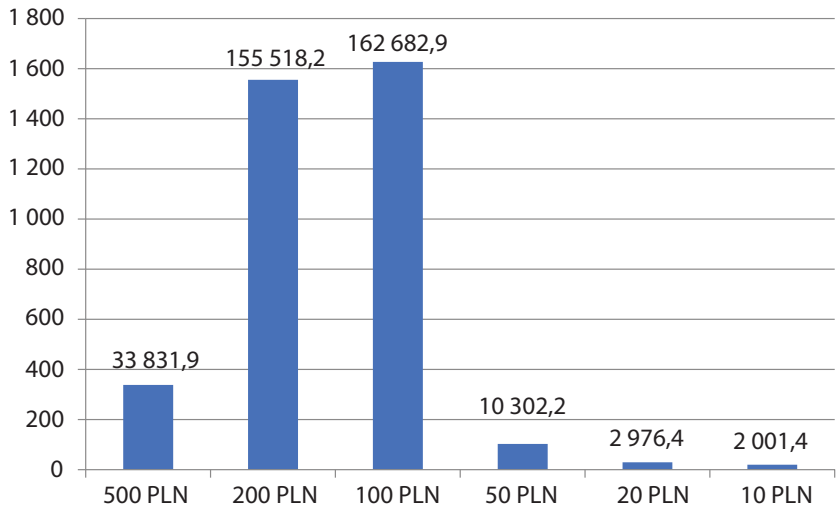
[4] February 10, 2017.

use it due to the high loss if a counterfeit banknote is accepted. It should also be noted that the original goal accompanying the introduction of this denomination into circulation was to reduce the issue costs (by reducing the volume of banknotes produced – especially limiting the volume of PLN 200 and efficient management of the strategic stock of banknotes stored by NBP, requiring less storage space and facilitating transport).

The banknote denomination associated with its volume in circulation provides information on which denominations are dominant in the value of the monetary base. This is shown in Fig. 2.

Fig. 2

Value of Polish banknotes in circulation, data in PLN million, data as of September 30, 2022.



Source: https://www.nbp.pl/home.aspx?f=/statystyka/pieniezna_i_bankowa/struktura-obiegu.html, structure of banknote circulation in Poland, December 20, 2022.

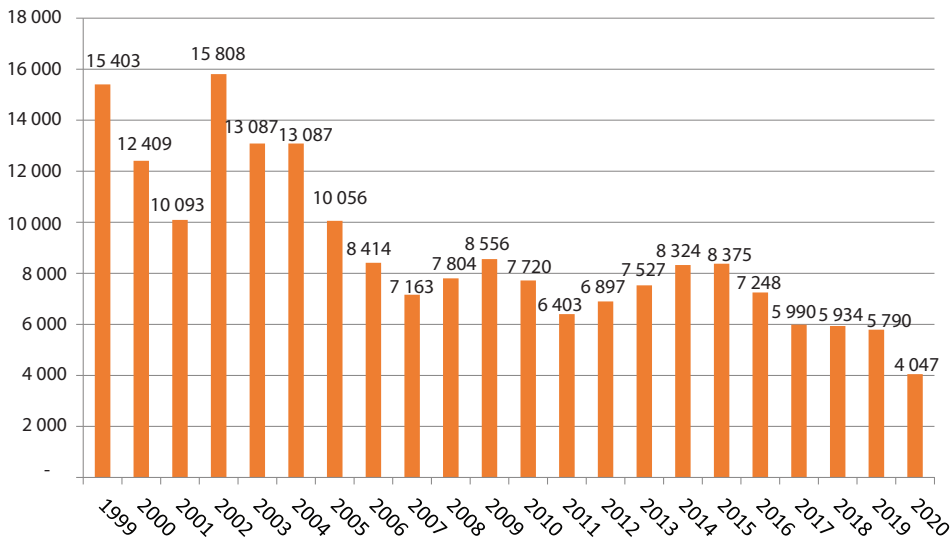
According to Fig. 2, the highest value of banknotes in circulation concerns PLN 100 banknotes and amounts to PLN 155.5 billion (44.3%). The second highest value concerns PLN 200 banknotes and amounts to PLN 63.4 billion (42.3%). These two types of banknotes account for 86.6% of the total value of Polish banknotes in circulation. Finally, the third highest value includes PLN 500 banknotes worth PLN 33.8 billion (9.2%). These observations may lead to the conclusion that the PLN 100, PLN 200 and PLN 500 banknotes provide the highest rate of return to criminals because their denominations are higher than the minimum (PLN 10 and PLN 20 banknotes) and therefore generate a higher counterfeit profit. Nevertheless, there are fundamental differences between the analysed banknote denominations as to their number in circulation. The PLN 100 and PLN 200 banknotes represent the highest volume shares in circulation, and the PLN 500 banknotes – the lowest share. A high proportion of circulation reduces the risk of detecting counterfeit notes (less

attention when accepting banknotes and checking their authenticity). In the case of banknotes that are rarely in circulation (as in the case of PLN 500), one can expect very significant attention from the person accepting such banknotes and thorough verification of the authenticity of such banknotes. This leads to the conclusion that the PLN 100 and PLN 200 banknotes may be the most vulnerable to counterfeiting. However, the condition for the correctness of the above conclusion is that, in the case of these denominations, counterfeiting does not require exceptionally difficult, time-consuming and costly activities. As Hans de Heij[5] points out, the pattern of counterfeiters' choice of non-extreme denominations also applies to euro banknotes (counterfeiters mainly target the €20 and €50 and tend to skip the lowest and highest denominations).

Counterfeiting money is a serious crime in Poland. Despite severe criminal sanctions, the level of counterfeiting remains relatively high and, to some extent, stable. Fig. 3 presents the number of criminal proceedings concerning counterfeiting of money in Poland initiated pursuant to Art. 310 of the Acton on Penal Code from June 6, 1997.[6]

Fig. 3

Number of criminal proceedings commenced in connection with Art. 310 of the Penal Code.



Source: http://www.statystyka.policja.pl/st/kodeks-karny/przestepstwa-przeciwko-18/63904,Falszowanie-pieniedzy-i-papierow-wartosciowych-art-310.html, Police statistics on counterfeiting of money and securities, December 20, 2022.

[5] H. de Heij, *Innovative Approaches to the Selection of Banknote Security Features: counterfeit analysis,* 'Banknotes of the World' 2010, No. 8, p. 19.

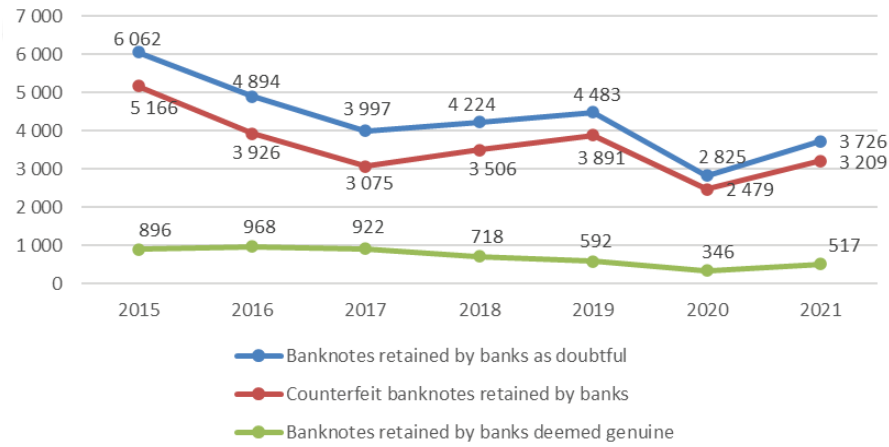
[6] Consolidated text: Dziennik Ustaw 2022, poz. 1138.

Figure 3 shows that the number of criminal prosecutions for money counterfeiting has ranged between 6,000 and 8,000 per year in recent years (except for a record low in 2020). This level has been observed since 2006. Before 2006, the number of proceedings was much higher and amounted to almost 16,000 in 2002. It is difficult to identify the reasons for the apparent decrease in the number of proceedings in 2006. This is not related to the modernisation of Polish banknotes (and the introduction of new security features), as it took place much later, *i.e.* in 2014 (10, 20, 50 and PLN 100) and 2016 (PLN 200). Therefore, a possible reason may be lower police efficiency or less activity of counterfeiting criminals. What seems to be particularly noteworthy is the record-low number of proceedings conducted in 2020. It amounted to only 4,000. It is therefore necessary to monitor this indicator in order to verify whether the value recorded in 2020 was incidental or whether we are dealing with a trend in this respect. It seems credible that the reason for the decrease in the number of proceedings in 2020 was the COVID-19 epidemic and the related restrictions on the functioning of public administration and the economy. This explanation is also consistent with the number of banknotes retained by banks as doubtful in 2020 (Fig. 4). During the COVID-19 epidemic, cash transactions were significantly reduced in favour of alternative payments (made with payment cards). The reduced volume of cash transactions in 2020 also contributed to the decline in the PPM ratio (Part Per Million: the number of counterfeit banknotes per million banknotes in circulation) (Fig. 6).

Banknotes that raise doubts as to their authenticity are most often reported by banks and commercial outlets. Figure 4 shows the statistics regarding such detentions by banks.

Fig. 4

Seizure of banknotes raising doubts as to their authenticity by banks (in items).



Source: Data provided to the author by the National Bank of Poland.

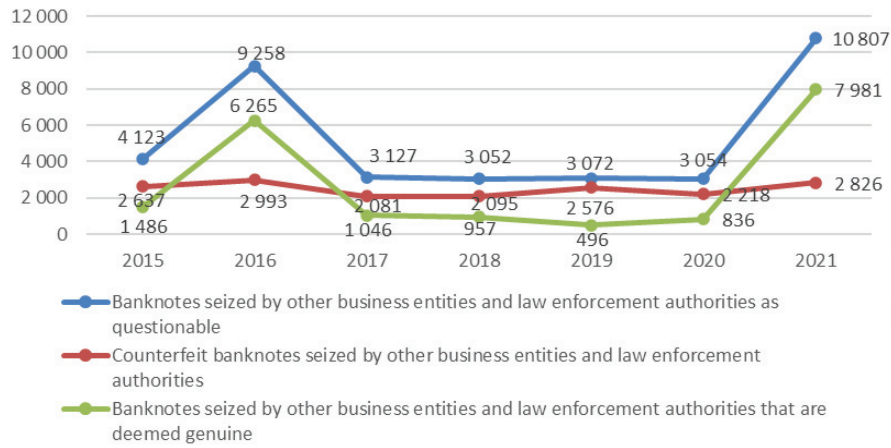
The data in Fig. 4 shows that in 2017–2019, the absolute number of banknotes seized by banks increased. In this group, the number of banknotes recognised as counterfeit also increased. The share of banknotes recognised as counterfeit in the total number of banknotes challenged by banks in the analysed years was above 80%, except for 2017 (77%). The year 2020 brought a significant change. As previously mentioned, in 2020, due to the COVID-19 epidemic, a number of restrictions on the functioning of the economy were introduced. The most important of them included: limiting the functioning of shopping malls, closing construction shops at weekends, closing hotels, introducing a ban on eating meals in restaurants, limiting the number of customers in stores, closing sports facilities, gyms, hairdressers and beauty salons, museums and others for customers, introducing restrictions on movement outside the place of residence. These restrictions significantly reduced payment transactions, in particular cash transactions, and thus limited the volume of banknotes used to carry out transactions, including the number of banknotes seized as doubtful. The number of banknotes retained by banks as doubtful fell to 2,825 in 2020, *i.e.* by 37.0%. It was only after the end of the epidemic that the volume of banknotes seized by banks as doubtful increased in 2021 to 3,726, *i.e.* by 31.9% compared to 2020, but at the same time 16.9% less than in 2019.

An interesting observation, however, is that in the entire period analysed in Fig. 4, the questioned banknotes in the majority of cases turn out to be counterfeit or forged. The level of banknotes considered counterfeit in the total number of banknotes questioned by banks is in the range of 80-88%, except for 2017, when it was 77%. This proves the effectiveness of the systems used in banks to verify the authenticity of banknotes and the high competence of bank employees. At the same time, it should be emphasised that after the restrictions on the functioning of the economy were lifted in 2021, the number of banknotes considered counterfeit increased to 3,209 pieces, *i.e.* by 29.4% compared to 2020, which may suggest that criminal groups have become more active after the epidemic period.

Entities questioning the authenticity of banknotes are also companies and law enforcement authorities. Figure 5 presents data on the seizure of banknotes by these institutions.

Fig. 5

Detentions of banknotes raising doubts as to their authenticity by law enforcement authorities and business entities other than banks (in items).



Source: Data provided to the author by the National Bank of Poland.

Fig. 5 leads to the conclusion that 2016 saw a particularly high number of cases where the authenticity of banknotes was challenged by business entities other than banks and by law enforcement authorities. The increase compared to the previous year amounted to 125%. Interestingly, in 2017, there was a decrease in these seizures to the level similar to that from before 2016. The abrupt increase was therefore of a one-off nature and concerned seizures of banknotes, not by banks, but by other economic entities and law enforcement authorities. The questioned banknotes in 2016 turned out to be authentic in most cases (68%). A possible explanation for this phenomenon is the introduction of modernised PLN 200 banknotes in 2016. If the public was not sufficiently informed about the new banknote design, this might have led to questioning the authenticity of the banknotes in retail outlets. Nonetheless, verification of this hypothesis would require an in-depth analysis of the questioned denominations and the reasons for the emerging doubts. Unfortunately, the author does not have such information. However, the coincidence of the introduction of a new banknote design into circulation and the abrupt increase in the level of questioning the authenticity of banknotes by retail outlets (but not banks) substantiates the hypothesis indicated, which in turn should lead to the conclusion that a very extensive and reliable information campaign is necessary in the event of changes in banknote designs in circulation.

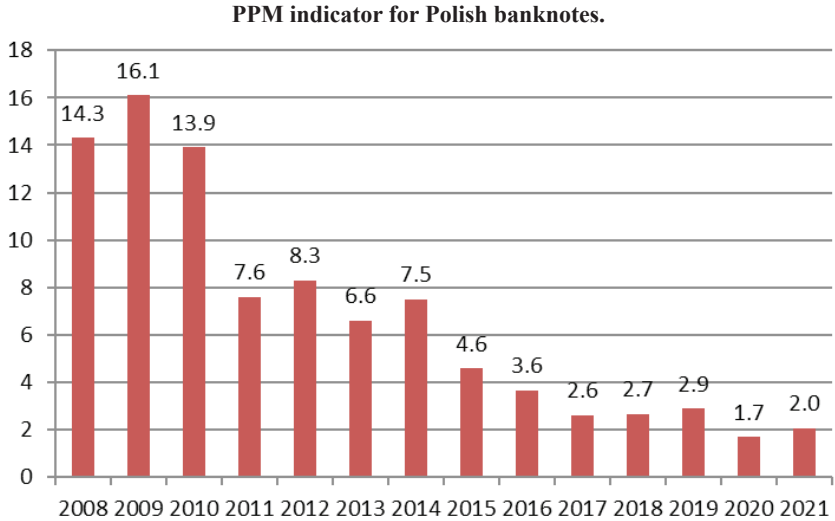
The number of banknotes questioned by law enforcement authorities and business entities other than banks after 2016 remained relatively constant until 2021, at around 3,000. In this number, the share of banknotes considered counterfeit was, apart from the special year 2016, over 60% and showed an upward trend. This proves the increasingly better qualifications of cashiers in business entities other than banks. It should be emphasised that the level of this indicator for 2019 (84%) remains close to the level observed in banks (87% in 2019), where competences in the field of verifying the authenticity of banknotes are much higher and which have machine sorters verifying the authenticity banknotes. The epidemic period in 2020 did not bring any significant changes in the number of questioned banknotes for the discussed group of entities (unlike banks), and the analysed indicators were similar to those observed in 2019. A significant change was brought by 2021, when the number of banknotes seized by business entities and law enforcement authorities other than banks and considered questionable reached a record level of 10,807, *i.e.* more than 3.5 times more than in 2020. Interestingly, the questioned banknotes mostly turned out to be genuine, and the number of banknotes considered counterfeit amounted to 2,826, *i.e.* 27.4% more than in 2020. This phenomenon may be a consequence of combining two factors. Firstly, after the epidemic period and the lifting of restrictions on the functioning of the economy, criminal groups could activate their activities in 2021. Nevertheless, the observed increase in the number of counterfeits does not correspond to the record increase in questionable banknotes. The presented results show that only 26.1% of the banknotes challenged in 2021 turned out to be counterfeits. Thus, the second factor influencing the increase in the volume of questioned banknotes was the erroneous perception of entities accepting cash as for the lack of authenticity of banknotes. If there appears a large scale mistake recognising genuine banknotes as counterfeit, it usually results from various types of production errors causing deviations in the appearance of the questioned (but authentic) banknotes[7] or errors made by banknote sorting and banknote authenticity verification machines (*e.g.* in non-bank entities dealing with the so-called cash-processing).

Counterfeit banknotes in circulation

The activity of counterfeiters can be analysed using the PPM (Part Per Million) indicator for Poland, which is presented in Fig. 6.

[7] However, there is no information about such events in the present case.

Fig. 6.



Source: National Bank of Poland, data made available at the author's request.

As shown in Fig. 6, the PPM index in Poland decreased significantly in two periods: in 2011, when it fell from around 14–16 to 7–8, and in 2015, when it fell to 4.6, and then gradually to 2.7 in 2018. The change from 2011 is not correlated with any security changes, but can be linked to the elimination of banknotes counterfeited by a large criminal group in 2010. However, it decreases to 4.6 in 2015 and further to 3.6 in 2016, 2.6 in 2017 and 2.7 in 2018 may suggest the effect of the banknote modernisation process, in line with the trend anticipated in the literature on the subject.[8] In 2020, the effect of the COVID-19 epidemic was quite clearly visible, resulting in a decline in PPM to a record low of 1.7 as a result of a significant decline in economic activity requiring the use of cash. In 2021, the PPM level increased to 2.0, which should be considered a highly satisfactory result. Particularly noteworthy, however, is the indicated decrease in PPM in the years 2015–2018 as a consequence of modernisation activities in relation to Polish banknotes.

The effects of the lower PPM index immediately after the modernisation of banknotes were observed not only in Poland but also in other countries. For example, in Namibia in 2012, the PPM for the old series of banknotes was 2.53 and was lowered to 0.04 for the modernised series of banknotes.[9] In Canada, the PPM reached an extreme level of 470 in 2014. Nevertheless, after banknote modernisation, cashier training, public campaign and strengthening of law enforcement, it was significantly reduced to 76 in 2008,

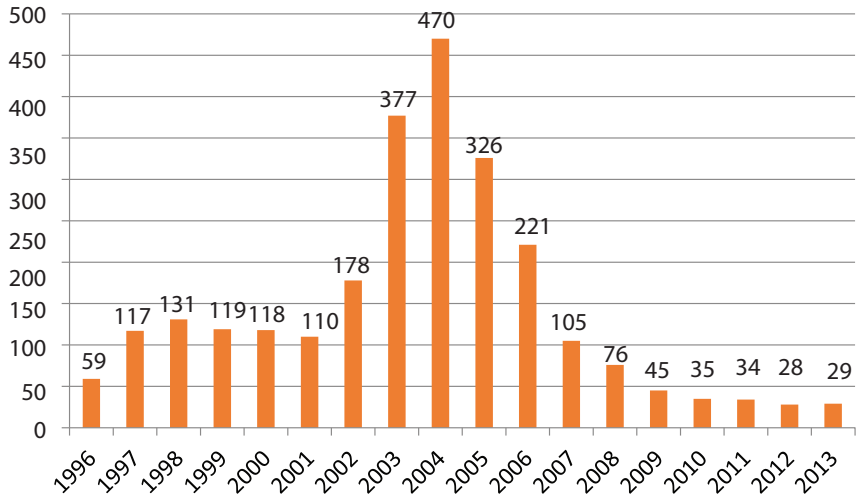
[8] R. Lewandowski, *Bezpieczeństwo państwa a bezpieczeństwo dokumentów publicznych i banknotów* [in:] M. Goc, T. Tomaszewski, R. Lewandowski (ed.), *Kryminalistyka – jedność nauki i praktyki. Przegląd zagadnień z zakresu zwalczania przestępczości*, Warsaw 2016, p. 295.

[9] Ibidem, p. 295.

29 in 2013 and 6 in 2022.[10] Figure 7 shows the PPM for Canadian dollars in the period 1996 – 2013. The decision to introduce a new series of banknotes was made by the Bank of Canada in 1997 in response to an increase in counterfeit activities. Initially, three new security features were used in the modernised banknotes.[11] However, they did not prove to be sufficient to protect the CAD 5 and 10 notes from counterfeiting. The first banknotes of the new series (10 CAD) were issued in 2001, and the last ones in 2004 (50 CAD). In 2002, due to the continued high level of PPM, the bank decided to introduce a new strategy aimed at meeting both the challenges posed by counterfeiters and the needs of society. This strategy included increasing the internal security of banknotes,[12] building security awareness among the public through education, increased activity in the prosecution of counterfeiters by the police and prosecutors, and removing older series of notes from circulation.[13] According to Meika Ball,[14] Remigiusz Lewandowski,[15] as well as Jill Moxley, Helen Meubus, and Maura Brown,[16] these changes ultimately led to a significant decrease in counterfeiting of Canadian banknotes.

Fig. 7

PPM indicator for Canadian banknotes.



Source: Own study based on: Annual Reports of the Bank of Canada 1996-2013; https://www.bankofcanada.ca/publications/, December 20, 2022.

The reduction of the PPM in Poland, Namibia and Canada after the modernisation of banknotes and the application of new security features leads to

[10] Bank of Canada, Annual Report 2022, p. 34.
[11] Hidden number, fluorescent elements and iridescent paint.
[12] Metallic holographic stripe, ghost image, recto-verso and security thread.
[13] J. Moxley, H. Meubus, M. Brown, *The Canadian Journey: An Odyssey into the Complex World of Bank Note Production*, 'Bank of Canada Review', 2007, autumn, p. 52.
[14] M. Ball, *Recent Trends in Banknote Counterfeiting*, 'RBA Bulletin' march 2019, p. 8.
[15] R. Lewandowski, *Bezpieczeństwo...,* p. 296.
[16] J. Moxley, H. Meubus, M. Brown, *The Canadian...,* p. 53–54.

the conclusion that there is a cause-and-effect relationship between these two phenomena. Of course, the observed correlation does not constitute direct evidence that the modernisation of banknotes reduces the criminal activity of counterfeiters. Such direct evidence would require surveying the counterfeiters themselves (convicted of counterfeiting) and examining their reactions to the banknote upgrades implemented by central banks. Unfortunately, such studies have not been carried out, which, by the way, creates very interesting directions for further study on the security of banknotes. Theoretically, the decreased PPM could be due to factors other than banknote modernisation, such as a reduction in counterfeiting activity by large criminal groups or a shift to forms of crime that are alternative to counterfeiting. However, studies on the Canadian case do not indicate such causes of the discussed phenomenon and do not confirm the presence of factors other than the modernisation of banknotes.[17] On the contrary, the Bank of Canada stated that the initial impact of its efforts to make banknotes more secure became apparent in 2005, when counterfeit levels remained high in absolute terms, but the number of counterfeit notes detected was significantly reduced and the value of counterfeits in circulation fell dramatically.[18] Currently, the PPM index for Canada is at a very low level (it was 6 for 2022).[19]

Slightly different conclusions can be drawn in the case of Poland. A significant decrease in the PPM indicator is visible in 2011, when no security changes were introduced, but in 2010, the police discovered a large criminal group specialising in counterfeiting banknotes. In this case, the law enforcement factor may be responsible for the discussed positive change in shaping PPM. Nevertheless, during the period of introduction of modernised Polish banknotes (2014 and 2016), there was no spectacular success in detecting large criminal groups of counterfeiters, and the police did not observe any particularly significant changes in criminal activity indicating a potential diversion of criminal proceedings from counterfeiting to other types of crime.[20] This suggests that the decline in PPM after 2016 was caused by the new security features used in Polish banknotes.

Technological developments and the availability of printing equipment, including 3D printing as well as high-resolution scanners and printers, give criminals the opportunity to obtain better quality counterfeits and perfect imitations of even relatively new security features. Therefore, central banks decide to periodically issue series of modernised banknotes. The frequency of such operations depends on the counterfeit resistance of existing banknotes and the scale of counterfeiting. For example, the

[17] Ibidem; M. Ball, *Recent Trends...*, Bank of Canada, Annual Reports 2004 – 2013, https://www.bankofcanada.ca/publications/, November 24, 2022.

[18] Bank of Canada, Annual Report 2005, p. 29-34.

[19] Bank of Canada, Annual Report 2022, p. 34.

[20] Raport o stanie bezpieczeństwa w Polsce 2014, http://isp.policja.pl/isp/aktualnosci/7789,Raport-o-stanie-bezpieczenstwa-w-Polsce-w-2014-r.html, November 24, 2022; Raport o stanie bezpieczeństwa w Polsce 2015, https://archiwumbip.mswia.gov.pl/bip/raport-o-stanie-bezpie/18405,Raport-o-stanie-bezpieczenstwa.html, November 24, 2022; Raport o stanie bezpieczeństwa w Polsce 2016, https://archiwumbip.mswia.gov.pl/bip/raport-o-stanie-bezpie/18405,Raport-o-stanie-bezpieczenstwa.html, November 24, 2022.

Bank of Canada introduced new series approximately every 15 years until its 2001/2004 issue. However, this development in the technology available to criminals has prompted Canada's central bank to upgrade more frequently, approximately every 10 years. As regards euro banknotes, the first series was issued in 2002 and the second series (with enhanced security features) 11 years later, *i.e.* in 2013.

The PPM rate in different countries is influenced by many factors, including the level of security of national banknotes, the level of crime, how cash is used, and the cost and availability of counterfeiting equipment.[21] Effective counterfeiting requires updating and introducing new security features that make the work of counterfeiters more difficult and costly. It is a never-ending process constituting a closed cycle. Once new security features are introduced, counterfeiters need time to find ways to successfully imitate them. After some time, they manage to do this, which in turn provokes a response from central banks developing new series with even more innovative security features, which – as discussed in the examples of Poland, Canada and Namibia – should lead to a reduction in the scale of counterfeit banknotes in circulation. Technological development is one of the most important factors determining crime, including money counterfeiting.[22] Importantly, counterfeiters do not usually use original production processes, original technologies or original materials and security features.[23] They are too expensive or impossible for most counterfeit criminal groups to obtain. However, the limitations indicated above do not apply to counterfeiting by states. A good example is the so-called superbanknote, *i.e.* a $100 banknote counterfeited by North Korea, which was produced using intaglio printing and the original substrate of US banknotes (whitened $1 notes).[24]

The relatively small number of counterfeit Polish banknotes also results from the limited liquidity of the zloty on international financial markets and the low nominal value in relation to some stronger currencies, such as the euro or the US dollar. The euro and the US dollar are international currencies, and the exchange rate against the zloty favours the choice of these foreign currencies by counterfeiters. Producing a single counterfeit euro or dollar banknote brings about 4–5 times higher return than counterfeiting a zloty banknote (due to the exchange rate and similar costs of counterfeiting). In addition, it is easier to distribute euro or dollar banknotes due to their nature as international currencies, widely accepted around the world.[25] This attractiveness of dollar or euro banknotes implies the number of counterfeit notes, much higher than in the case of Poland. Fig. 8 shows the PPM indicator in the euro area.

[21] E. Quercioli, L. Smith, *The Economics of Counterfeiting*, 'Econometrica', 2015, No. 83(3), pp. 1214–1216; F. van der Horst I in., *Does Banknote Quality Affect Counterfeit Detection? Experimental evidence from Germany and the Netherlands*, 'DNB Working Paper', 2016, No. 499, p. 39.

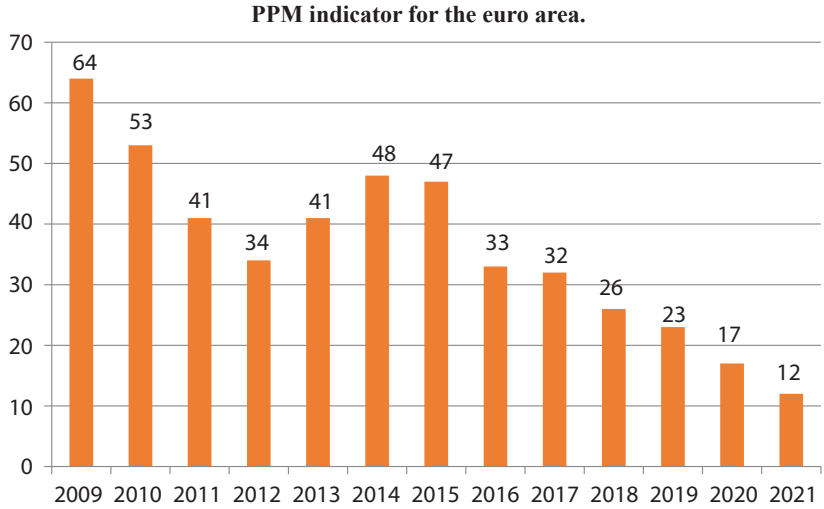
[22] B. Hołyst, *Czynniki determinujące prognozę przestępczości* [in:] B. Hołyst (ed.), *Prognozowanie kryminologiczne w wymiarze społecznym*, t. 1, Warsaw 2017, p. 232.

[23] E. Jakielaszek, *Dokument tożsamości w aspekcie współczesnej przestępczości* [in:]: M. Goc, T. Tomaszewski, R. Lewandowski (ed.), *Kryminalistyka*..., p. 303.

[24] E. Quercioli, L. Smith, *The Economics of Counterfeiting*, p. 1214.

[25] M. Ball, *Recent Trends in Banknote Counterfeiting*, p. 9.

Fig. 8



Source: https://www.ecb.europa.eu/pub/annual/html/index.pl.html, annual reports of the European Central Bank, December 20, 2022.

In recent years, the PPM index in the euro zone has been showing a dynamic downward trend and in 2021 it reached the level of 12. It is still significantly higher than in Poland, despite the relatively modern security features used in euro banknotes. However, this is the price the euro pays for its status as an international currency and valid in much of Europe. It should be emphasised that the decrease in PPM observed in relation to the euro is a consequence of many factors, including, in particular, the increase in the security level of the new Europa series banknotes, continuous cooperation with law enforcement authorities and regular communication with the public and training for entities handling cash circulation at the pan-European and national level.[26]

The European Central Bank indicates that euro cash will continue to be widely used, also after 2030. Taking into account the prospect of a long-term presence of cash in circulation, the ECB continues to prepare for the introduction of further modern and more secure euro banknotes in order to maintain public trust, ensure the security of using the notes and to ensure the stability of the euro area. Given the length and complexity of the design process for future banknotes, preparations have already started, including research and development, regular consultations with stakeholders and the public, and the production of test banknotes with the new security features. The ECB is expected to select the final designs for the new euro banknotes in 2024.

[26] In May 2019, new €100 and €200 banknotes with innovative security features were put into circulation; Following the end of the introduction of the new Europa series of banknotes in 2019, the Eurosystem started preparations for the development of new banknote designs.

Classification of counterfeit banknotes

There are five main types of counterfeit money:
1) primitive forgery,
2) occasional falsification,
3) counterfeiting by petty criminals,
4) counterfeiting by professional criminal groups,
5) counterfeiting by other countries.

Each of the above-mentioned types of counterfeiting has its own specificity related to the motivation, scale of operations, materials and equipment used, range of activity and the quality of counterfeits.

Primitive forgeries are usually based on manual modifications of lower denomination banknotes in order to give them a higher value (*e.g.* pasting a fragment with a higher number specifying the denomination of the banknote) or the use of ready-made prints that are slightly graphically similar to banknotes. Digital devices such as scanners, laser printers or other types of printers, let alone professional printing equipment, are not used to produce such counterfeits. These are counterfeits that are easy to detect, although in special conditions, *e.g.* very heavy traffic in a retail outlet, very poor lighting, etc., it is possible to let them circulate. The distribution of counterfeits is usually done directly by the counterfeiter himself. Motivation in the case of primitive forgeries varies, although the dominant is the desire to buy drugs or alcohol paid for with counterfeit banknotes. Due to the lack of use of mass duplication devices and the low quality of counterfeits as well as high detectability, crudely counterfeited banknotes do not pose a significant threat to the economic security of the state.[27]

Occasional forgeries are largely a consequence of the wide availability of printing and imaging devices. The low price of such devices combined with the prospect of additional income from the crime of counterfeiting create motivation for criminals responsible for this type of counterfeiting. These are usually young people, often without criminal record, and forgery is not a permanent source of income for them, but only an occasional benefit. For counterfeiting, they use inkjet or laser printers, multifunctional printing and scanning devices, high-resolution scanners and graphics software. The quality of counterfeits is obviously higher than that of primitively processed or counterfeited banknotes, but at the same time it remains limited by the technical parameters of available printing and scanning devices. Counterfeits are most often distributed by counterfeiters or persons associated with them in commercial outlets. Due to the use of devices, the number of counterfeits from one forger can be significant, although it does not exceed a dozen or so pieces.

When discussing forgeries made using laser printers or copiers, it is worth noting that these devices individualise each printout by means of

[27] In this context, the importance of banknotes and the fight against counterfeiting for the economic security of the country should be emphasized, expressed primarily in the stability of the payment system related to the certainty and reliability of cash transactions. The certainty and reliability of cash transactions can only occur in the absence of public doubts about the authenticity of banknotes in circulation.

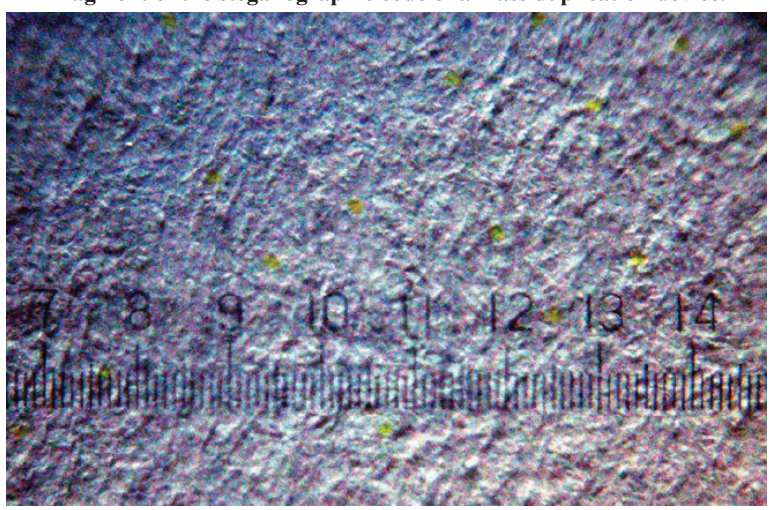
microdots forming a specific code occupying an area of a square of approx. 1 cm2. Each code column is responsible for the following parameters:[28]

— 1 – parity column;
— 2 – minute in which the page was printed;
— 3 – not used;
— 4 – not used;
— 5 – time when the page was printed;
— 6 – day on which the page was printed;
— 7 – month in which the page was printed;
— 8 – year in which the page was printed;
— 9 – not used;
— 10 – separator;
— 11, 12, 13, 14 – serial number of the printer in the binary coded decimal system;
— 15 – destiny unknown.

Therefore, printouts from laser printers and copiers are equipped with steganographic elements that allow experts to verify in what period and on what specific device the counterfeits of banknotes (or documents) were made. This is extremely helpful in investigations against counterfeiters. A fragment of such a code is presented in Fig. 9. It should be emphasised that the diameter of each point of the code does not exceed 0.1 mm.

Fig. 9

Fragment of the steganographic code of a mass duplication device.



Source: https://en.wikipedia.org/wiki/Machine_Identification_Code, November 24, 2022.

The analysis of Polish court judgements regarding crimes under Art. 310 § 1 k.k. indicates that in the last decade, the dominant group

[28] https://www.eff.org/files/filenode/printers/ccc.pdf, November 24, 2022.

has been occasional counterfeiters. A perfect example of how these criminals operate is the justification of one of the verdicts, which describes the counterfeiting process involving the use of a laptop and a multifunctional device, scanning the original banknote, printing the scanned image of the banknote on an inkjet printer on ordinary A4 sheets, and cutting out the counterfeits from the printed sheets[29].

A slightly different group of counterfeiters are petty criminals. Their motivation comes from constant income through counterfeiting, which means that this practice is not incidental, but systematic and sometimes lasting for years. This approach makes them use the equipment characteristic of occasional counterfeiters. What's more, some investments in the form of better production materials (paper, paints, imitations of holograms, imitations of watermarks, etc.) become profitable for them. In this group, the quality of the counterfeits themselves and the ingenuity of counterfeiters in imitating specific security features are at a much higher level. Counterfeit notes are distributed by counterfeiters or related criminals in their country. The devices used and the motivation of a fixed income mean that the counterfeit volumes of banknotes can already be significant, *i.e.* even thousands of pieces.

Professional criminal groups may also specialise in counterfeiting banknotes. This is a major source of income for them. For this purpose, they use high-quality production equipment, including – apart from common printing and scanning devices – digital printing presses and plotters. Highly qualified people with experience in printing and papermaking often participate in the production process. The quality of counterfeits is usually good, and the volumes produced are very large. Counterfeiting banknotes by professional criminal groups involves organised supply chains of the necessary materials that closely imitate the originals (inks, including inks visible in certain light ranges, holograms, paper, security thread) and distribution systems. The scope of activities of such groups is international.

Nevertheless, the most serious group is counterfeiting by other countries. State institutions involved in counterfeiting have devices, technologies, know-how and materials that allow them to produce counterfeits that are very similar to the originals and are not easy to detect for ordinary users and more advanced ones (*e.g.* bank tellers) as well as experts. Moreover, such counterfeits might not be detected by machine authentication systems. Banknote paper with parameters as close to the original as possible, original production processes (including steel engraving and type-offset), as well as banknote security features made with precision and extraordinary similarity to authentic security features are all used in the production of such counterfeits. The use of professional materials and raw materials, as well as the reconstruction of the original production process, distinguishes this type of counterfeiting from other types of

[29] Judgement of the District Court in Białystok of October 3, 2014, ref. no. III K 75/14, https://orzeczenia.ms.gov.pl/search/advanced, December 20, 2022.

counterfeiting in terms of technology, where imitation of processes and materials dominates. Due to the extremely high quality of counterfeits produced by foreign countries, the banknotes they counterfeit represent a serious risk to economic security. However, this risk currently applies mainly to international currencies, in particular the US dollar and the euro.

State counterfeiters are guided by political goals (related to the desire to destabilise the financial situation in a given country and weaken international confidence in a given currency) or goals related to the expected financial benefits. Both of these goals can be pursued simultaneously. The most famous contemporary example of counterfeiting banknotes by other countries is the so-called superbanknote that was (is?) produced by North Korea. Some sources estimate that over US$45 million worth of counterfeits have been put into circulation by North Korea since 1989, though this figure appears to be significantly underestimated.[30] It is assumed that counterfeit banknotes from North Korea are distributed using Korean diplomatic missions and international criminal groups cooperating with this state. One of the US responses to the problem of counterfeit $100 notes was to modernise the denomination and introduce it into circulation in 2013. The most recent case of state counterfeiting involves Libyan dinars, which according to the US State Department, were allegedly counterfeited by the Russian state-owned banknote and document maker Goznak. The whole affair came to light following Malta's seizure of a shipment of 1.1 billion of the banknotes in question to Libya in May 2020.[31]

Counterfeiting of money by states has a long history, and the most spectacular examples of it are presented in the table – in relation to selected armed conflicts.

Table 1

Examples of banknote counterfeiting by other countries.

Armed conflict	Party involved in counterfeit	Counterfeit currency
1	2	3
Conflict between Italian city-states (1423-1508)	Milan	Venetian ducats
American Revolution (1775-1783)	Great Britain	Colonial currencies
Napoleonic Wars (1805-1812)	France	Austrian bank scripts, Russian rubles

[30] National Research Council, *A Path to the Next Generation of U.S. Banknotes: Keeping Them Real*, The National Academies Press, Washington, DC 2007, https://doi.org/10.17226/11874, December 20, 2022, p. 27.

[31] https://www.state.gov/seizure-by-malta-of-1-1-billion-of-counterfeit-libyan-currency/, November 24, 2022.

1	2	3
Mexican-American War (1846-1848)	Mexico	Republic of Texas dollars
American Civil War (1861–1865)	United States	Dollars of the Confederate States of America
World War I (1914–1918)	Great Britain	Turkish lira
Bolshevik Revolution (1917–1921)	White Army	Russian rubles
World War II (1939–1945)	Great Britain	Burmese rupees, Chinese yuan, German Reichmarks, Malaysian dollars
	Germany	British Pounds, French Francs, Hungarian Pengos, US Dollars, Yugoslav Dinars
	Japan	Chinese yuan
	USA	Burmese rupees, German Reichmarks, Japanese yen
Bay of Pigs Invasion (1961)	USA	Cuban peso
Vietnam War (1964–1973)	USA	North Vietnamese dongs
Terrorist activities (1991–1996)	Unknown	US dollars

Source: D.E. Altig, *Why Is Stable Money Such a Big Deal?*, 'Economic Commentary' may 2002, p. 3.

The quality of banknotes counterfeited by criminal groups varies. Fig. 10 shows examples of counterfeit watermarks in the PLN 50 banknote. They testify to a great diversity of the artistic abilities of counterfeiters, including practically no such abilities. Practice shows that counterfeiters sometimes create new, high denominations, as in the case of a 1,000 EUR banknote and a very clumsy counterfeit based on the original 1,000 ZWD banknote. The counterfeit is shown in Fig. 11 and the genuine Zimbabwean banknote in Fig. 12.

Fig. 10

Examples of watermark imitation on the PLN 100 banknote.

Source: Material provided to the author by the Central Forensic Laboratory of the Police.

Fig. 11

Counterfeit EUR 1,000 banknote made on the original ZWD 1,000 banknote.

Source: http://sudexpert.gov.by/ru/list_news_occurrence_n.html?news_id=7087, November 2022.

Fig. 12

Original 1,000 ZWD banknote.

Source: https://www.rbz.co.zw/, November 24, 2022.

Counterfeiters, especially professional criminal groups, use their artistic and printing skills related to recreating the graphic design of banknotes, but at the same time they use inventiveness in creating imitations of security features. Methods used by counterfeiters include, for example:[32]

— applying coloured cotton fibres to the paper surface coated with glue;
— covering the surface of the paper with a solid that masks the luminescence of the paper in UV light;
— keeping the paper substrate in a solution of specific chemical substances (derived from disinfectants) that change the pH of the paper and dye it in a way resembling original banknote paper;
— imitating the convexity of steel engraving by using the press's own design (without the hairline effect on the surface);
— imitating a holographic strip using holographic strips from food packaging;
— knurling, embossing and puncturing the surface of banknotes.

However, the catalogue of solutions used by counterfeiters is open and limited only by their invention. Below are photographic examples of various types of security features used by counterfeiters. Fig. 14 presents an imitation of intaglio printing, and Fig. 15 – an imitation of microprints. The analysis of these security imitations shows how far they differ from the originals.

[32] R. Nesterowicz, *Rozważania o fałszerstwach pieniędzy* [in:] R. Cieśla (ed.), *Zagadnienia z dowodu ekspertyzy dokumentów*, Wrocław 2017, p. 365–366.

Fig. 14

Imitation of gravure printing.

Source: Material provided to the author by the Central Forensic Laboratory of the Police.

Fig. 15

Microprint imitation.

Source: Material provided to the author by the Central Forensic Laboratory of the Police.

Conclusions

The research presented in this article leads to the following conclusions. First of all, it should be noted that Polish banknotes are highly resistant to counterfeiting. Both the number of criminal prosecutions for counterfeiting and the rate of counterfeits per 1 million banknotes in circulation (PPM), as well as the absolute number of banknotes seized and eventually found to be counterfeit, have remained low in recent years. The PLN 100 and PLN 200 banknotes seem to be at the highest risk of counterfeiting, as they, on the one hand, have a high face value and, on the other hand, a high share in the volume of all banknotes in circulation.

The indicated high resistance of Polish banknotes to counterfeiting is a consequence of several factors. The most important of them is the appropriate quality of the security features used and the relatively recent modernisation process of the banknotes. The experience of both the Polish and other banknote markets shows that the modernisation of banknotes reduces the scale of counterfeiting. The local nature of the Polish currency is also of great importance. It is not of interest to international criminal groups involved in money counterfeiting, as the zloty is not an international currency and is not an alternative means of payment used in other countries in parallel to national currencies, such as the US dollar or euro. In addition, the exchange rate of the zloty against the US dollar or euro makes the Polish currency even less attractive in relation to the profit generated from counterfeiting banknotes, even by domestic criminals.

Finally, it should be pointed out that the period of the COVID-19 epidemic and the related restrictions in the functioning of the economy and restrictions in cash transactions (in favour of on-site card payments and various types of online payments) resulted in a temporary reduction in the number of counterfeit banknotes in circulation. This phenomenon, however, is definitely limited in time.

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Keywords: banknotes, security, money counterfeiting.

Summary: The article presents the phenomenon of the banknote counterfeiting in Poland from a broad perspective. It was investigated using an analytical approach based on various factors characterising the discussed practice. The denominations most exposed to counterfeiting (PLN 100 and PLN 200) were identified, the number of criminal proceedings conducted in cases of money counterfeiting was examined, and the structure of banknotes seized as doubtful was analysed. In addition, an analysis of the PPM indicator showing the number of counterfeits per 1 million banknotes in circulation was carried out, comparing Poland's data with data from other countries. The article also presents the basic classification of banknote counterfeits. The conducted research leads to the conclusion that Polish banknotes are characterised by high resistance to counterfeiting, resulting from the recent modernisation of the banknotes and their well-chosen security features. At the same time, the Polish currency – due to its local nature and relative weakness against the EUR and USD – is not attractive to international criminal groups specialising in counterfeiting.

Palarbas clave: billetes, seguridad, falsificación de moneda

Resumen: El presente artículo presenta un amplio panorama de la evolución de la falsificación de billetes en Polonia. Este fenómeno se investigó con un enfoque analítico basado en los diversos factores que caracterizan dicha práctica. Este fenómeno se investigó con un enfoque analítico basado en los diversos factores que caracterizan dicha práctica. Se determinaron los billetes más propensos a la falsificación (100 y 200 PLN), se examinó el número de procedimientos penales incoados en casos de falsificación y se analizó la estructura de los billetes incautados como dudosos. Además, se realizó un análisis del indicador PPM que muestra el número de billetes falsos por cada millón de billetes en circulación, comparando los datos de Polonia con los de otros países. El artículo también explica una clasificación básica de la falsificación de billetes. La investigación realizada lleva a la conclusión de que los billetes polacos presentan una gran resistencia a la falsificación, debido a la reciente modernización de los billetes y a sus bien seleccionados mecanismos de seguridad. Al mismo tiempo, la moneda polaca - debido a su carácter local y a su relativa debilidad frente al euro y al dólar - no resulta atractiva para los grupos delictivos internacionales que se especializan en la falsificación.